APPENDIX F

PALEOETHNOBOTANICAL ANALYSIS

The following is the complete text of the Paleoethnobotanical report as submitted.

POLLEN, PHYTOLITH, MACROFLORAL, AND CHARCOAL IDENTIFICATION FOR THE WHITEHURST FREEWAY PROJECT, WASHINGTON, D.C.

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Paleo Research Labs Technical Report 98-09

Prepared For

Parsons Engineering Science, Inc.
Fairfax, Virginia
March 1998

INTRODUCTION

Pollen, phytolith, macrofloral, charcoal identification, and/or PET (potentially edible tissue) analyses were conducted on samples from sites 51NW103, 51NW117, and 51NW117W in the Whitehurst Freeway Project. These three sites are located at the confluence of the Potomac River and Rock Creek in urban Washington, D.C., and represent primarily occupations from approximately 1000 B.C. to the 19th century A.D. The various ethnobotanic analyses were used to provide information concerning plant resources that were available to and utilized by the occupants of these sites.

METHODS

Pollen

A chemical extraction technique based on flotation is the standard preparation technique used in this laboratory for the removal of the pollen from the large volume of sand, silt, and clay with which they are mixed. This particular process was developed for extraction of pollen from soils where preservation has been less than ideal and pollen density is low.

Hydrochloric acid (10%) was used to remove calcium carbonates present in the soil, after which the samples were screened through 150 micron mesh. The samples were rinsed until neutral by adding water, letting the samples stand for 3 hours, then pouring off the supernatant. A small quantity of sodium hexametaphosphate was added to each sample once it reached neutrality, then the beaker was again filled with water and allowed to stand for 3 hours. The samples were again rinsed until neutral, filling the beakers only with water. This step was added to remove clay prior to heavy liquid separation. After the clay was removed the samples were dried and powdered. The dry samples were mixed with zinc bromide (density 2.1) for the flotation process. The heavy liquid separation was repeated at least once. All samples received a short (20 minute) treatment in hot hydrofluoric acid to remove any remaining inorganic particles. The samples were then acetolated for 3 minutes to remove any extraneous organic matter. This method also recovers starch granules present in the samples.

A light microscope was used to count the pollen at a magnification of 600x. Starch granules, when present, were tabulated along with pollen. Pollen preservation in these samples varied from good to poor. Comparative reference material collected at the Intermountain Herbarium at Utah State University and the University of Colorado Herbarium was used to identify the pollen to the family, genus, and species level, where possible.

Pollen aggregates were recorded during identification of the pollen. Aggregates are clumps of a single type of pollen and may be interpreted to represent pollen dispersal over short distances, or the actual introduction of portions of the plant represented into an archaeological setting. Aggregates were included in the pollen counts as single grains, as is customary. The presence of aggregates is noted by an "A" next to the pollen frequency on the pollen diagram. Samples with pollen counts under 100 pollen grains are samples that usually are reported by other analysts as containing insufficient pollen for analysis. However, partial counts obtained in two of the samples (21 and 24) from this stratigraphic column provided significantly more information than would have been obtained with a designation of "insufficient pollen". Pollen samples 22 and 23 did not yield sufficient pollen to graph. All forms noted during the count of these two samples are represented on the pollen diagram by pluses (+).

Indeterminate pollen includes pollen grains that are folded, mutilated, and otherwise distorted beyond recognition. These grains are included in the total pollen count, as they are part of the pollen record.

Phytolith

Extraction of phytoliths from these sediments also was based on heavy liquid floatation. Approximately 50 ml of sediment was added to 50 ml of sodium hexametaphosphate (0.1 molar solution) to suspend the clays. The sample was then sieved through 150 micron mesh. The sample was allowed to settle for two hours, then the supernatant was poured off, which contained clay. This settling time allowed the phytoliths to settle to the base of the beaker. The samples were mixed with water, allowed to settle for two hours, and the supernatant discarded several times, until the supernatant was clear. Liquid bleach was added to the sample and allowed to sit overnight to destroy the organic fraction in the sample. Rinses were continued to remove the bleach, then the remaining clays. The last two times the sample was allowed to settle the time was reduced to one hour. This procedure removes most of the clays. Once most of the clays were removed, the silt and sand size fraction was dried. The dried silts and sands were then mixed with zinc bromide (density 2.3) and centrifuged to separate the phytoliths, which will float, from the other silica, which will not. Phytoliths, in the broader sense, may include opal phytoliths and calcium oxylate crystals, both of which are retrieved (if present in the sediment) using this method. If calcium carbonates are present, use of glacial acetic may be employed to dissolve the calcium carbonates without destroying any calcium oxylates present. Any remaining clay is floated with the phytoliths, and is further removed by mixing with sodium pyrophosphate and distilled water. The samples are then rinsed with distilled water, then alcohols to remove the water. After several alcohol rinses, the samples are mounted in Cinnamaldehyde for counting with a light microscope at a magnification of 500x.

Flotation

The macrofloral samples were floated using a modification of the procedures outlined by Matthews (1979). Each sample was added to approximately 3 gallons of water, then stirred until a strong vortex formed. The floating material (light fraction) was poured through a 150 micron mesh sieve. Additional water was added and the process repeated until all floating material was removed from the sample (a minimum of 5 times). The material which remained in the bottom (heavy fraction) was poured through a .5 mm mesh screen. The floated portions were allowed to dry.

The light fractions were weighed, then passed through a series of graduated screens (US Standard Sieves with 2 mm, 1 mm, .5 mm and .25 mm openings) to separate charcoal debris and to initially sort the seeds. The contents of each screen were then examined. Charcoal pieces larger than 2 mm in diameter were separated from the rest of the light fraction and the total charcoal weighed. A representative sample of these charcoal pieces were broken to expose a fresh cross-section and examined under a binocular microscope at magnifications up to 140x. The weights of each charcoal type within the representative sample also were recorded. The remaining light fraction in the 2 mm, 1 mm, and .5 mm sieves was scanned under a binocular stereo microscope at a magnification of 10x, with some identifications requiring magnifications of up to 70x. A portion of the finest material in the 0.25 mm screen also was examined under a magnification of 10x. The material which passed through the 0.25 mm screen was not examined. The heavy fractions were scanned at a magnification of 2x for the presence of botanic remains. Macrofloral remains were identified using manuals (Martin and Barkley 1973; Musil 1978; Schopmeyer 1974) and by comparison with modern and archaeological references. Estimates of frequencies were calculated from the sort of a portion of the total volume floated and are noted in the macrofloral table with an asterisk (*). The term "seed" is used to represent seeds, achenes, caryopses, and other disseminules. Remains from both the light and heavy fractions were recorded as charred and/or uncharred, whole and/or fragments.

For individual charcoal identification samples, the charcoal pieces were broken to expose a fresh cross section and examined under a binocular microscope at magnifications up to 70x. Wood/Charcoal samples were identified using manuals (Core et al. 1976; Panshin and Zeeuw 1980), and by comparison with modern references. Remains were recorded as charred and/or uncharred fragments. Because these charcoal samples were to be sent for radiocarbon dating, clean laboratory conditions were used during the identification and imaging processes to avoid contamination. All instruments were washed between samples, and samples were protected from contact with modern charcoal.

When examining macrofloral remains from prehistoric sites, it has become most acceptable to consider only charred seeds for the interpretation of a feature and utilization of resources (Minnis 1981). Few seeds live longer than a century, and most for a much shorter time period (Harrington 1972; Justice and Bass 1978; Quick 1961). It is presumed that once the seeds have died, decomposing organisms act to decay the seeds. Interpretation of uncharred seeds to represent presence in the prehistoric record is considered on a sample-by-sample basis. Extraordinary conditions for preservation are important in this interpretation.

PET Analysis

The charred remains and/or residues were pulverized in centrifuge tubes using a teflon rod. Schulze solution was used to dissolve the charred material and release trapped starches and/or phytoliths. Schulze solution is a mixture of strong nitric acid (75%) and potassium (or sodium) chlorate. Oxidation is rapid and any pollen remaining in these charred fragments is expected to be oxidized by this solution. Samples were rinsed with dilute potassium hydroxide (KOH) to remove humates, then distilled water following completion of the digestion with Schulze solution. Microscope slides were made with glycerine for examination with a binocular microscope at magnifications ranging from 400x to 600x.

ETHNOBOTANIC REVIEW

It is a commonly accepted practice in archaeological studies to reference ethnological (historic) plant uses as indicators of possible or even probable plant uses in prehistoric times. It gives evidence of the exploitation, in historic times, of numerous plants, both by broad categories, such as greens, seeds, roots, and tubers, etc. and by specific example, i.e., seeds parched and ground into meal which was formed into cakes and fried in grease. Repetitive evidence of the exploitation of resources indicates a widespread utilization and strengthens the possibility that the same or similar resources were used in prehistoric times. Ethnographic sources do document that with some plants the historic use was developed and carried from the past. A plant with medicinal qualities very likely was discovered in prehistoric times and the usage persisted into historic times. There is, however, likely to have been a loss of knowledge concerning the utilization of plant resources as cultures moved from subsistence to agricultural economies and/or were introduced to European foods during the historic period. The ethnobotanic literature serves only as a guide indicating that the potential for utilization existed in prehistoric times--not as conclusive evidence that the resources were used. Pollen and macrofloral remains, when compared with the material culture (artifacts and features) recovered by the archaeologists, become indicators of use. Plants represented by charred macrofloral remains will be discussed in the following paragraphs in order to provide an ethnobotanic background for discussing the remains.

Native Plants

Galium (Bedstraw, Cleaver's)

The young shoots of Galium (bedstraw, Cleavers) may be boiled as potherbs. Seeds may be roasted, ground, and used to make a beverage very similar to coffee. When dried, Galium plants have a pleasant aroma and may be used as a bedding material. A purple dye may be obtained from the roots. Galium also may be used for medicinal purposes. Ojibwa Indians used Galium plants as a diuretic, for pulmonary, kidney, urinary, respiratory and skin problems, and to treat eczema and ringworms. Penobscot Indians also used Galium plants to treat rhinitis (runny nose) and people who spit up blood. Galium plants are found in rich, moist soils in thickets, woods, and waste places (Duke 1986:60; Erichsen-Brown 1979:337-338; Fernald 1950:1321; Kirk 1975:127-128; Peterson 1977:50; Reidhead 1984:396).

Juglandaceae (Walnut Family)

The Juglandaceae (walnut) family includes hickory nuts and pecans (Carya), as well as walnuts (Juglans). Nut production is cyclical in nature, with most trees producing a good crop once every two to three years. Talalay et al. (1984:338) note that "evidence for the use of nuts as a food source is nearly ubiquitous in aboriginal eastern North America from at least the Early Archaic (ca. 8000-6000 B.C.) to the ethnographic-historic present."

Carya (Hickory)

Hickory nuts (Carya sp.) are recorded as the most important nut used by Indians of North America at the time of contact. Several species of hickory are sweet and edible, although some are bitter. The nuts were usually harvested in the fall when the outer husks dried and split. During prehistoric times, competition with animals was likely and the nuts probably were collected early. Nuts usually were shelled by crushing, often using two rocks. Wooden mortars were used historically for processing large quantities of hickory nuts. After the nuts were crushed, they were usually placed in boiling water. Most of the shell fragments would sink to the bottom, while the nutmeats would float or be held in suspension. The nutmeats could then be skimmed off and used immediately or dried for storage. Many ethnographic sources suggest that hickory nut oil and "milk" were the desired product. The pulverized nuts were placed in slowly boiling water for a long period of time. The oil from the nutmeats (hickory butter) would separate and float to the surface where it was skimmed off and stored for later use. The rest of the nutmeats would dissolve into a milky fluid (hickory milk) that was drunk or used as stock for soup. Hickory sap can be used like maple sap. Hickory nuts contain approximately three percent water, 13 percent protein, 69 percent fat, and 13 percent carbohydrate. The various species of edible hickories are found in a variety of habitats including rich moist soils of bottomland woods, dry to moist upland woods, alluvial floodplains of major streams, slightly acidic soils, dry ridges, and well-drained hillsides (McGee 1984:265; Munson 1984:338, Peterson 1977:190; Riedhead 1981:189-192; Talalay et al. 1984:338-359).

Juglans (Walnut)

Walnuts (Juglans) are noted to have been used less intensively than hickory nuts (Reidhead 1981:186). Both black walnut (Juglans nigra) and butternut (Juglans cinerea) produce sweet nuts that may be eaten raw or roasted. Walnuts and butternuts may be harvested from late September to late December to early January. Competition with other animals is not as great, probably due to the bitter outer husk which does not split and separate from the nut like hickories. Early in fall, the fibrous outer husk is green, firm, and very difficult to remove. In December, however, the husks are black, rotten, and fairly easy to remove. Walnuts and butternut trees are not found close to one another like hickories can be. The roots of walnut and butternut produce a substance called juglone which is toxic to other walnut and butternut trees, and the trees are intolerant of shade (Talalay et al. 1984:340). Walnuts and butternuts were processed using a hammerstone and anvil method. The nut was placed on a large flat stone, then cracked using a smaller, hand-held hammerstone. The nutmeat was then picked out of the shell and eaten plain or added to broth, grain dishes, or cakes. Walnuts and butternuts were not usually processed for the oil since husk portions get caught in the shell and nutmeat mass. When this is placed in boiling water, the husk fragments will float to the top. If left boiling long enough, the husk fragments dissolve and make everything black and bitter-tasting. Walnut and butternut sap also may be used like maple sap (Peterson 1977:188; Talalay et al. 1984:354-355).

The inner bark of Juglans nigra was used as an emetic and a laxative, and the bark chewed for toothaches. Husk juice was used to treat ringworm and the husk was chewed for colic and poulticed for inflammation. Tea made from dried leaves was astringent and may be used as an insecticide against bedbugs. Black walnut may be found in the deep rich soil of bottomlands and fertile hillsides (Foster and Duke 1990:276; Peattie 1966:121-125; Talalay et al. 1984:339-340). Juglans cinerea grows best along streams and ravines, particularly in well-drained gravelly soil, but also may be found in the rich soils of deciduous woods. Butternut husks are very sticky, and were used to make a brown dye. The white inner bark yields an orange or yellow dye. A bark tea was used to treat rheumatism, headaches, and toothaches. A strong, warm tea was used on wounds to stop bleeding and to promote healing. Tapeworms and fungal infections were treated with oil from butternuts (Foster and Duke 1990:276; Peattie 1966:119-121; Talalay et al. 1984:340).

Phytolacca americana (Pokeweed)

Phytolacca americana (pokeweed, pokeberry) is a non-woody, native herbaceous perennial with reddish or purplish stems. The young stems are thick and succulent like asparagus, and young stems and shoots can be collected in the spring and cooked as potherbs. The young shoots and leaves contain beta carotene, which is not destroyed by boiling. The ripe, dark purple berries also can be cooked and eaten. Berries ripen in the fall and can persist on the plants well into the winter. The roots, mature stems and leaves, seeds, and unripe berries contain the alkaloid phytolaccine and are noted to be poisonous. Indian groups used the root as a medicinal resource. The root was valued as an emetic and used to treat fever and other illnesses. The phytolaccine is reported to have laxative and narcotic effects. Phytolacca is native from Maine to Minnesota and south to Texas and Florida. It is found in thickets, meadows, clearings, cultivated fields, pasture lands, waste places, and open places, mostly on rich, gravelly soils (Angell 1981:142-143; Brill and Dean 1994:39-41; Martin 1972:50; Medsger 1966:142-143; Millspaugh 1974:557-561; Peterson 1977:46).

Rubus (Raspberry/Blackberry Group)

The Rubus group includes blackberry, cloudberry, dewberry, salmonberry, thimbleberry, wineberry and yellowberry. Raspberries and blackberries are usually bristly or prickly, and all species are edible. The berries were collected in the late summer and eaten fresh, cooked, or dried and stored for future use. Berries also were used as sweeteners. Blackberries are noted to provide potassium, magnesium, calcium, phosphorus, beta carotene, and vitamin C, while raspberries provide vitamins A, B-complex, and C, as well as iron, calcium, phosphorus, volatile oil, sugars, citric and malic acids, pectin, and silicon. Raspberry and blackberry leaves may be dried and made into a medicinal tea. The roots, leaves, and berries are astringent and may be used to treat dysentery and diarrhea and as a gargle for sore throats. Raspberry leaves and berries also may be used as a wash for sores, ulcers, and abrasions. An infusion of raspberry leaves was used by native women during pregnancy to facilitate delivery. Plants in the Rubus group occur as vines or shrubs of dry soil or rich bottomlands in thickets, open places, clearings, forest edges, mountain slopes, wetlands, ravines, and waste places (Angell 1981; Brill and Dean 1994:96-98, 112-114; Harris 1972:69, 153-154; Hutchens 1991:44, 230-233; Pennington and Church 1985:74, 79; Peterson 1977:184).

Vitis (Wild Grape)

Vitis (wild grape) are thornless, high-climbing vines that often climb to the tops of large forest trees. Some vines can be parasitic. Grape leaves are an excellent source of beta carotene and niacin, and may be collected in the summer and boiled as potherbs. The fruits ripen in the late summer and fall and are round, few-seeded, juicy berries that can be purple, blue, black, red, or amber. Wild grapes are less sweet than commercial varieties but contain more flavor. Grapes were eaten fresh and were dried for future use. They provide potassium, beta carotene, fructose, tartaric acid, quercitin, tannin, malic acid, gum, and potassium bitartrate. A grape leaf or seed infusion is noted to be astringent and used to treat bleeding and diarrhea. Indian groups used it for stomachaches and hepatitis. The fruit, leaves, and tendrils also were used to treat diarrhea and snakebite. Leaves were used for poultices, bandages, and for wrapping foods. Wild grapes are reported to be diuretic and may be used to treat urinary tract infections. The skins contain reservatrol, which can prevent cardiovascular disease by reducing blood clots and raising high-density lipoprotein cholesterol. Wild grape vines are found in woods, thickets, in wetlands, and along streams and riverbanks (Angell 1981:156; Brill and Dean 1994:165-168; Medsger 1966:53-59; Muenink 1988:15-16; Peterson 1977:198).

PHYTOLITH REVIEW

Phytoliths are silica bodies produced by plants when soluble silica in the ground water is absorbed by the roots and carried up the plant via the vascular system. Evaporation and metabolism of this water result in silica precipitation in and around the cellular walls. The general term phytoliths, while strictly applied to opal phytoliths, may also be used to refer to calcium oxylate crystals produced by a variety of plants, including cottonwood and willow. Opal phytoliths, which are distinct and decay-resistant plant remains, are deposited in the soil as the plant or plant parts die and break down. They are, however, subject to mechanical breakage and erosion and deterioration in high pH soils. Phytoliths are usually introduced directly into the soils in which the plants decay. Transportation of phytoliths occurs primarily by animal consumption, man's gathering of plants, or by erosion or transportation of the soil by wind, water, or ice.

The major divisions of grass short-cell phytoliths recovered include festucoid, chloridoid, and panicoid. Smooth elongate phytoliths are currently of no aid in interpreting either paleoenvironmental conditions or the subsistence record because they are produced by a large number of grasses. Phytoliths tabulated to represent "total phytoliths" include all silica and/or calcium oxalate forms representing plants. Frequencies for all other bodies recovered are calculated by dividing the number of each type recovered by the "total phytoliths".

The festucoid class of phytoliths is ascribed primarily to the subfamily Pooideae and occur most abundantly in cool, moist climates. However, Brown (1984) notes that festucoid phytoliths are produced in small quantity by nearly all grasses. Therefore, while they are typical phytoliths produced by the subfamily Pooideae, they are not exclusive to this subfamily. Chloridoid phytoliths are found primarily in the subfamily Chloridoideae, a warm-season grass that grows in arid to semi-arid areas and require less available soil moisture. Chloridoid grasses are the most abundant in the American Southwest (Gould and Shaw 1983:120). Panicoid phytoliths occur in warm-season or tall grasses that frequently thrive in humid conditions. Twiss (1987:181) also notes that some subfamily Chloridoideae members produce both bilobate (panicoid) and festucoid phytoliths. "According to Gould and Shaw (1983, p. 110) more than 97% of the native US grass species (1,026 or 1,053) are divided equally among three subfamilies Pooideae, Chloridoideae, and Panicoideae" (Twiss 1987:181).

Buliform phytoliths are produced by grasses in response to wet conditions (Irwin Rovner, personal communication, January 1991), and are to be expected in wet habitats of floodplains and other places. Phytoliths referred to as "pillows" are the same as those reported by Rovner (1971). While these phytoliths are described, no taxonomic nor environmental significance has been assigned. They most probably represent grasses.

Trichomes and papilla represent epidermal hairs on grasses and/or sedges. Epidermal forms represent epidermal grass cells. Dicot forms are noted, although not all have been identified to genus or family and represent dicotyledonous plants. Magnolia-type phytoliths have been compared with photos of phytoliths produced by Magnolia (Kondo n.d.a:66; Kondo n.d.b:83).

DISCUSSION

Sites 51NW103, 51NW117, and 51NW117W in the Whitehurst Freeway Project area are located on several terraces on the west bank of Rock Creek near the confluence of Rock Creek and the Potomac River in Washington, D.C. This area has experienced extensive urban development and is typically covered with gravel or dirt parking lots, scrub grass, and a few scattered shrubs and trees. During prehistoric occupations, this area most likely would have supported rich floral communities.

Site 51NW103 (Peterhouse Prehistoric Site)

Site 51NW103 is located on a high terrace approximately 170 meters east of Rock Creek. The prehistoric component of this site consists of an Ab horizon representing a prehistoric surface that dates generally to the Woodland period. These deep, charcoal-rich deposits contained fire-cracked rock, lithic debris, and ceramics. The deposits are believed to represent refuse from an intensive occupation site. The majority of the diagnostic artifacts recovered from the deposits were Late Woodland ceramics, although several Late Archaic artifacts suggest the area experienced an earlier, less intensive occupation.

Flotation sample 4009 represents fill from the prehistoric refuse deposits (Table 1). This sample contained a charred Galium seed fragment (Tables 2 and 3), suggesting that bedstraw was utilized by the Late Woodland occupants of the area. Four charred unidentified seed fragments also may represent seed processing activities. Uncharred seeds and rootlets represent modern plants at the site. The sample also contained numerous sclerotia. Sclerotia are commonly called "carbon balls". They are small, black, solid or hollow balls that range from 0.5 to 4mm in size. Sclerotia are associated with mycorrhizae fungi, such as Cenococcum graniforme, that have a mutualistic relationship with tree roots. Sclerotia are the resting structures of the fungus, identified by Dr. Kristiina Vogt, Professor of Ecology in the School of Forestry and Environmental Studies at Yale University. Many trees are noted to depend heavily on mycorrhizae and may not be successful without them. "The mycelial strands of these fungi grow into the roots and take some of the sugary compounds produced by the tree during photosynthesis. However, mycorrhizal fungi benefit the tree because they take in minerals from the soil, which are then used by the tree" (Kricher and Morrison 1988:285). Sclerotia appear to be ubiquitous and are found with coniferous and deciduous trees including Abies (fir), Juniperus communis (common juniper), Larix (larch), Picea (spruce), Pinus (pine), Pseudotsuga (Douglas fir), Acer pseudoplatanus (sycamore maple), Alnus (alder), Betula (birch), Carpinus caroliniana (American hornbeam), Carya (hickory), Castanea dentata (American chestnut), Corylus (hazelnut), Crataegus monogyna (hawthorn), Fagus (beech), Populus (poplar, cottonwood, aspen), Quercus (oak), Rhamnus fragula (alder bush), Salix (willow), Sorbus (chokecherry), and Tilia (linden) (McWeeney 1989:229-130; Trappe 1962).

The charcoal record from sample 4009 suggests that a variety of woods were burned as fuel. Charcoal types in this sample include Aesculus, Carya, Fraxinus, Juglans, Quercus, and unidentified bark and charcoal. The Quercus charcoal includes both members of the white oak group and red oak group. The sample also contained uncharred insect fecal pellets, a few insect fragments, and a moderate amount of rock/gravel.

Ceramic residue sample 1357-1 is also from the prehistoric refuse deposit. The burned residue was digested with Schulze solution and examined for the presence of starches and/or phytoliths. The sample included one buliform and one smooth elongate phytolith, representing grasses. In addition, two sponge spicules represent the probable presence of water or intrusion from the surrounding sediments. Tracheary elements and plant fibers were present but are not considered diagnostic. None of these remains contribute to the identification of the residue.

Feature 363 is a shallow, sub-round cluster of fire-cracked rock and ceramic sherds noted in the prehistoric refuse deposit. The majority of the ceramic sherds represent the Late Woodland period. Fill from this feature was floated as sample 4047. A charred Galium seed fragment, a charred Phytolacca americana seed fragment, and a charred Vitis seed fragment suggest that the Late Woodland occupants of the site were utilizing bedstraw, pokeweed, and wild grapes. Charcoal was dominated by Carya and Fraxinus, with smaller amounts of Juglans, Morus, Platanus, and Quercus charcoal present. Hickory, ash, walnut, mulberry, sycamore, and oak wood appear to have been burned as fuel at the site. An uncharred, modern Portulaca oleracea seed, uncharred rootlets, sclerotia, and rock/gravel complete the record.

Sample 1311-4 represents burned residue from a Late Woodland ceramic sherd found in the fill of Feature 363. A single sponge spicule was recovered from this sample, suggesting that water was present or that this remain was introduced from the surrounding sediment. Tracheary elements and plant fibers were not considered diagnostic.

Flotation sample 4024, charcoal samples 4003, 4022, 4045, 4040, and 4055; and ceramic residue sample 1331-1 were recovered from a gravel lag deposit containing cultural material found below the prehistoric refuse deposit. This deposit may represent a lag on which the Ab horizon formed, and the cultural material found in it represents the upper refuse deposit. Alternatively, this deposit may represent the remnant of an Archaic deposit that has been extensively reworked by alluvial action. Flotation sample 4024 yielded few charred remains. A few pieces of Platanus and Quercus charcoal suggest that sycamore and oak wood were burned. Two pieces of charred unidentified bark fragments also were recovered. Uncharred rootlets from modern plants, sclerotia, and rock/gravel were the only other remains to be recovered.

Charcoal samples 4003, 4022, and 4040 all contained pieces of Cornus charcoal (Table 4), suggesting that dogwood was burned. Sample 4045 consisted of Quercus charcoal, representing use of oak wood as fuel. The charcoal in sample 4055 was too small to be identified.

Ceramic residue sample 1331-1 yielded a buliform phytolith, which is a common form produced by grasses. Plant fibers and charred plant tissue fragments were noted. A single dicot bulky phytolith also was present. The phytoliths recovered suggest presence of grasses and possibly a conifer. It should be noted that at least some of the remains in this sample may result from contamination from surrounding sediments, since the residue was scraped from the sherd prior to being submitted for analysis and preliminary cleaning procedures were not carried out.

The macrofloral record from site 51NW103 suggests that the Woodland occupants of this area utilized bedstraw, pokeweed, and wild grapes. Bedstraw is noted for its medicinal properties, as well as utilitarian uses, while pokeweed and wild grapes are edible. Analysis of ceramic sherd residues was inconclusive. Charcoal types suggest that a variety of wood was burned as fuel, including buckeye, hickory, ash, walnut, mulberry, sycamore, and oak. Cornus charcoal from the gravel lag deposit may represent Late Woodland or possibly Late Archaic use of dogwood as fuel. The presence of charcoal indicates that these trees would have been available to the prehistoric occupants of the site for providing edible and medicinal resources, as well as wood for fuel.

51NW117 (Ramp 3)

Site 51NW117 is located at the edge of Rock Creek Parkway, 75 meters west of the current creek bank. The primary prehistoric feature at this site is a shallow pit believed to represent a cremation burial (Feature 283). The pit fill contained charcoal-stained soil, calcined bone, and grave goods typical of late Middle Woodland burials. The feature was loosely capped with large stones. Charcoal from the pit fill yielded radiocarbon dates of 1290 ± 70 BP and 1330 ± 50 BP. A stratigraphic column of pollen and phytolith samples represents fill above, within, and below Feature 283. Sample 22 represents the level containing the cremated remains proper, while samples 23 and 24 were collected beneath the remains and samples 19, 20, and 21 from sediments above the remains. Sample 18, the uppermost sample, is expected to represent relatively recent deposits.

The pollen record for this sequence yielded a sparse pollen record from the subsoil (sample 24) that indicates a mixed forest (Figure 1, Table 5). Pinus pollen was moderately abundant, and lesser quantities of Quercus, Carya, and Betulaceae pollen were noted. Ground cover associated with this mixed pine and hardwood forest included Low-spine Asteraceae (members of the aster or sunflower family such as ragweed and others), Brassicaceae (mustard family), Cheno-ams, Medicago-type legumes (medick-type), and Poaceae (grasses). Numerous starch granules were recovered from this sample indicating that grass seeds deteriorated in these sediments. Sample 23 did not yield sufficient pollen for analysis, although it contained a similar quantity of pollen to sample 24. The difference was the increased quantity of other organic matter that made finding the pollen more difficult and time consuming. Never-the-less, the majority of the pollen recovered from this sample represents trees, indicating a continuation of a forest that included pines and various hardwoods including at least oak and members of the birch family.

Sample 22, representing the level containing the cremated remains, yielded absolutely no pollen. A single fern spore was recorded. Absence of pollen is consistent with the interpretation of a cremation, since pollen is expected to be destroyed by open flames. Therefore, the absolute absence of pollen in this sample combined with the presence of at least small quantities of pollen in the underlying samples supports the interpretation of a cremation.

Samples 21 through 18 all were dominated by Low-spine Asteraceae pollen, indicating disturbed ground and the growth of weedy members of the aster family such as ragweed. Pollen concentration also increased in these samples. Recovery of large quantities of Low-spine Asteraceae pollen usually is considered to be a signature of historic deposits, since ragweed often accompanies disturbance at Anglo sites. Only sample 18 yielded Sporormiella dung fungal spores, which represent a dung fungus that becomes more abundant in Historic Period sediments following the historic introduction of grazing animals. Its increasing presence in historic samples has been noted in numerous palynological studies (Davis 1987). Sporormiella fungal spores are not confined to the dung of introduced grazers, but also occur in dung from moose, wild sheep, deer, elk, caribou, and rabbits. The increase of Sporormiella spores in historic sediments may relate to changing land use patterns and increase in the length of time that herds of animals occupy any given area. No pollen types typical of plants introduced by Europeans were recovered from this record, so the only evidence of probable modern depositing is found within sample 18. It is possible that the large quantities of Low-spine Asteraceae pollen are the result of the growth of ragweed or other closely related plants as weeds in the pit as it filled in or that the sediments were mixed, yielding a similar pollen signature. Pollen evidence for trees in the vicinity of this site in samples 21 through 18 include Carya, Juniperus, Magnolia/Liriodendron-type, Pinus, and Quercus. Understory plants included Cirsium-type (thistle), Low-spine Asteraceae, High-spine Asteraceae, Liguliflorae, Brassicaceae, Cheno-ams, Cyperaceae, Phlox-type, Poaceae, Polygonum aviculare-type, Rosaceae, and Rosa-type. Starches are noted primarily in sample 21, where all the forms recovered are produced by grasses and probably represent decomposition of grass seeds.

The phytolith record for this column includes evidence for grass short cells representing all three divisions of grasses: tall grasses, short grasses, and cool-season grasses (Figure 2). The larger phytoliths in all samples showed pitting, which is interpreted as evidence of dissolution. This indicates that the silica of phytoliths has been put back into solution in the sediments for repeated uptake by plants. Repeated dissolution of phytoliths erodes part of the phytolith population in the sediments. If smaller particles are dissolved faster than larger particles, as one would expect, the dominance of these samples by the more substantial and larger phytoliths is an artifact of sediment conditions and partial dissolution of the phytolith record.

Sample 24, the lowest sample, was dominated by buliform phytoliths, which are relatively large. Other forms noted in abundance include the relatively large and massive dicot blocky forms and elongates. Dicot blocky forms are common in conifers, such as pines, and oak. Grass short cells and trichomes, as well as the elongates, represent grasses. Again, there appears to be a mixture of tall grasses, short grasses, and cool-season grasses. Phytoliths are far less abundant in this sample than in most of the rest of the samples.

Sample 23, which was collected immediately below the cremated remains, produced a very large quantity of elongate forms and a reduction in buliforms and dicot blocky forms. This sample yields the first evidence of a form described as "Magnolia-type, thin with sharp ridges", most probably representing magnolia trees. These relatively thin forms appear to break easily, as many of the phytoliths recovered appeared to be fragments. This sample provides the first evidence of Magnolia-type phytoliths with holes, a much more substantial phytolith, also indicating the presence of magnolia leaves. This sample yielded starch granules consistent with those produced by grass seeds, indicating that grass seeds probably deteriorated in this area. Decreases in buliforms suggest drying conditions, and the increase in elongate smooth phytoliths indicates presence of a relatively large grass population. Interestingly, there is no significant change in the distribution of total festucoid, chloridoid, and panicoid phytoliths, representing cool season, short, and tall grasses. The decrease in dicot blocky forms suggests a reduction in trees that is not indicated in the pollen record.

Sample 22, representing the level of the cremated remains, contained phytoliths indicating the presence of grasses. The quantity of festucoid short-cell phytoliths increased, particularly those with a crescent shape. Total panicoid short-cell phytoliths also increased, as did chloridoid short-cell phytoliths. This may reflect a difference in preservation or sediment conditions or may reflect an increase in grasses in this layer. If the latter is true, it suggests use of grasses in the pit. The reduction of buliform phytoliths suggests that the grasses represented did not grow under particularly wet conditions, since the cells that control leaf roll (in response to drought conditions) had not silicified even though other cells had silicified. Elongate forms were still moderately abundant but dicot blocky forms were not, suggesting that pine needle and possibly oaks leaves were not used or were present only minimally. This sample yielded the largest quantity of Magnolia-type thin forms with sharp ridges, suggesting that magnolia might have been included with the cremation or burial.

Samples 21, 20, and 19 all yielded relatively large quantities of buliforms and dicot blocky forms, indicating that grasses probably were well-watered and that pines and oaks probably were relatively abundant in the local forest. In light of the large quantities of Low-spine Asteraceae pollen noted in these samples, it is interesting to note that Asteraceae plates were no more abundant in these samples than they were in other samples. Grass short cells were poorly represented, but there is evidence of all three types of grasses (cool-season, short, and tall grasses) in these samples. The relative homogeneity of the phytolith record argues for mixing of these deposits.

Sample 18, the uppermost sample, yielded a very different phytolith signature. Buliforms declined, and grass short cells and trichomes increased. Dicot blocky forms have declined in frequency, and elongate forms are present in a moderate frequency. This record suggests an increase in the local grass population and perhaps thinning of the forest.

Sample 5007-I represents a textile fragment recovered from Feature 283. This textile fragment was processed as a PET specimen and examined for phytoliths and starch granules. Absolutely no grass or sedge phytoliths were observed, indicating that these fibers are not grass or sedge. This analysis indicates that the textile fibers represented in this sample do not represent a plant that produces silica phytoliths.

Flotation samples 5005 and 5013 were collected from fill within the cremation burial pit. Sample 5005 contained an abundance of Pinus charcoal (Tables 6 and 3), suggesting that pine wood was selected for the cremation. A moderate amount of unidentifiable vitrified charcoal also was present. Vitrified charcoal has a glassy appearance due to heat fusion. An uncharred modern Brassicaceae silique, a possible lithic flake, biotite, and rock/gravel were the only other remains to be recovered.

Two charred Phytolacca americana seed fragments were present in flotation sample 5013, suggesting that pokeweed was utilized. This sample also contained several charred, braided and single fiber fragments. These fibers may represent the same material as the textile fragment from the burial pit (sample 5007-I). One small fragment appeared to include both warp and weft, so this fragment was selected for processing. Once again, absolutely no grass or sedge phytoliths were recovered. If these fibers represent a monocot, it must be a monocot that does not produce phytoliths. Pinus again dominated the charcoal record. Numerous pieces of unidentifiable tissue fragments and charcoal pieces also were present in the sample. Uncharred rootlets from modern plants, sclerotia, charred bone fragments, biotite, and rock/gravel complete the record.

Charcoal samples 5004 and 5019 also were recovered from the fill of Feature 283. A charred Juglans nutshell fragment was present in sample 5004 (Table 4), suggesting that walnuts were processed and/or included as a grave goods. This sample also contained pieces of Fraxinus and Pinus charcoal, indicating that ash and pine wood were burned. Large fragments of Fraxinus and possible Gleditsia triacanthos charcoal were present sample 5019, indicating that ash and possible honey locust were burned.

Samples 5008 and 5024 and ceramic residue sample 3063-5 were recovered from a mixed historic/prehistoric deposit consisting of early-to-mid-nineteenth century domestic material overlaid on and intermixed with an existing prehistoric surface. Feature 283 was found underlying this stratum. Flotation sample 5008 contained a charred Asteraceae seed, a charred Galium seed, charred Phytolacca americana seed fragments, and charred pieces of vitrified tissue. Several types of uncharred seeds represent modern plants. A variety of small charcoal pieces were recovered from this sample including Carya, Cornus, Juglans, Juniperus virginiana, Morus, Pinus, Quercus, and unidentified fragments. Several pieces of calcined bone fragments and rock/gravel also were present.

Charcoal sample 5024 consists of charred material remaining after radiocarbon dating. A date of 7670 + 80 BP was returned for this sample. The sample consisted of pieces of Quercus charcoal, possibly other charcoal types, and numerous small pieces of vitrified tissue. The pieces of vitrified tissue were digested with Schulze solution and examined for starches and/or phytoliths. A single, large, sub-square starch, with a diamond-shaped hilum and a strong cross under cross-polar illumination was recorded. This starch granule has not been noted in any reference samples examined, so the identification of the plant represented remains unidentified.

Ceramic residue sample 3063-5 yielded a great variety of remains. Fibers and tracheary elements were not considered diagnostic. Three dicot bulky phytoliths probably represent the presence of conifer needles. Charred plant tissue fragments were present but not identifiable. A single deteriorated starch granule was recovered. Unfortunately, it was deteriorated beyond the point of description. A single, unidentified phytolith was recovered from this sample. It is highly unusual in shape, being roughly triangular and exhibiting spines that project at a right angle from the edge of the phytolith. This form is expected to be relatively unique in the plant kingdom, but it has not been identified. At present, no identification of foods that might have been processed in the vessel represented by this sherd can be made.

Pollen and phytolith analysis of samples collected below the cremated remains, from the level containing the cremated remains, and above the cremated remains provide information concerning vegetation prior to and after the burial. Pollen and phytolith recovery from sediments below the remains point to vegetation consisting of a mixed hardwood/pine forest, grasses, and groundcover that included other herbaceous plants. The cremation sample (22) was completely devoid of pollen, supporting an interpretation that this feature contains cremated remains. Phytoliths recovered from this level point to use of magnolia in the cremation or burial. In addition, phytoliths present in this sample may represent plants that grew in the area at or near the time of the cremation or remains that were in the sediment prior to its removal during construction of the pit. Grasses and some dicots were present, including coniferous trees. The combined pollen and phytolith records are consistent with an interpretation that samples 21, 20, and 19 represent sediments put back into the pit following the burial. The records are fairly homogeneous, which they would be if they represented trash fill removed from this area during construction of the pit. Sample 18 is significantly different from the others primarily in its phytolith content and in the presence of Sporormiella dung fungal spores in the pollen record. This sample indicates that the forest probably receded or thinned and that grasses were more abundant.

The charred macrofloral record from the cremation burial pit suggests that pokeweed berries and walnuts were processed and/or included as grave goods. Pine, ash, and possible honey locust appear to have been burned as fuelwoods. Fibers could not be identified through microscopic examination for phytoliths or starch granules. However, the absence of silica phytoliths indicates that these fibers were neither grasses nor sedges.

Charred macrofloral remains from an upper stratum of mixed prehistoric and historic deposits include an Asteraceae and bedstraw seed, pokeweed seed fragments, and pieces of vitrified tissue. Vitrified tissue from sample 5024 was identified as probably representing maize, indicating that it is likely derived from the historic portion of this occupation. A variety of charcoal types were present in this mixed stratum including hickory, dogwood, walnut, eastern red cedar, mulberry, pine, oak, and unidentifiable vitrified pieces. Calcined bone fragments also were present.

51NW117W (West)

This site was located on the lowest terrace above Rock Creek, between Rock Creek Parkway and the current stream bank. This site may have been immediately adjacent to the stream in prehistoric times. Feature 502 was formed on a natural gravel bar lying on flood-scoured Pleistocene alluvium. This gravel bar was an open prehistoric surface during the Woodland period and possibly during the latter part of the Late Archaic. A large amount of ceramic and lithic debris, chipped stone, fire-cracked rock, charcoal, and charcoal-stained sediments were intermixed with natural cobbles and gravel. Late Woodland artifacts were the most common, and charcoal from this feature yielded radiocarbon dates ranging from 960 ± 50 BP to 1110 + 90 BP.

Flotation samples 7025 and 7029 were recovered from fill of Feature 502. Both samples contained charred Juglandaceae nutshell fragments (Tables 7 and 3), suggesting that hickory nuts and/or walnuts were processed. Recovery of charred Phytolacca americana seed fragments also suggest use of pokeweed. These samples contained a few charred bone fragments and numerous calcined bone fragments that may represent processing of animal remains in this area. Both samples also contained uncharred seeds and rootlets from modern plants, sclerotia, and rock/gravel.

Sample 7025 contained a charred unidentifiable seed fragment that may represent seed processing activities. A few pieces of Quercus charcoal suggest that oak wood was burned as fuel. Unidentifiable charcoal and unidentified bark fragments also were present. A few small pieces of Carya, Morus, Pinus, Quercus, and unidentifiable charcoal were present in sample 7029, suggesting that hickory, mulberry, pine, and oak were burned as fuel.

Charcoal sample 7063 also was collected from Feature 502. This sample contained charred Carya nutshell fragments, suggesting that hickory nuts were processed. Pieces of Fraxinus, Pinus, and Quercus charcoal indicate that ash, pine, and oak wood were burned.

Samples 6107-3, 6176-7, and 6113-14 represent the burned residue from ceramic sherds found on the natural gravel bar deposits. These residues were scraped from the sherds prior to being submitted for analysis, and therefore, were mixed with small quantities of debris from the surrounding sediment matrix. This mixing makes interpretation of the presence of some remains difficult and points to the fact that some of the remains recovered probably were introduced from the sediment matrix and were not part of the charred residue. Remains expected as a result of this mixing include, but are not limited to, forms representing grasses and conifers and other forms noted in the phytolith record from the stratigraphic samples. This burned residue was digested with Schulze solution and examined for starches and/or phytoliths.

* Sample 6107-3 exhibited a single spiny elongate phytolith that is typical of grasses and a hollow starch granule of medium size, which may be produced by grass seeds. Fibers and

tracheary elements were numerous, and charred plant tissue fragments were noted. Several fragments of round diatoms and sponge spicules were present. Round diatoms and sponge spicules represent organisms that grow in water, suggesting that this ceramic sherd was part of a vessel used to boil foods or that water was used in the cooking process. Alternatively, it is possible that these forms were introduced with sediment that infiltrated the residue.

* Sample 6176-7 yielded tracheary elements and plant fibers, but these are not considered diagnostic. A single sponge spicule was recovered. Phytoliths included single grass crenate and dicot rectangular forms, indicating the presence of grasses and possibly a conifer or oak. Recovery of these phytoliths may reflect mixing of sediments with the charred residue.

Sample 6113-14 yielded a large, diagnostic starch granule typical of those produced by Solanum. The starch exhibited an eccentric hilum, strong concentric rings, and a strong cross under cross-polar illumination. At 62 microns, this starch granule is outside the size range of starch granules observed in native Solanum jamesii, although not all native Solanum roots have been examined for starch granules. Therefore, identification is left at the genus level of Solanum (potato). In addition, a single grass buliform phytolith was recovered, which might be present as a result of cooking grasses or through contamination from the surrounding sediment. Tracheary elements and plant fibers also were present.

Flotation sample 7041 was taken from a natural gravel deposit intermixed with ceramics and lithic debris that may have been an extension of Feature 502. Charcoal from this deposit yielded a radiocarbon age of 740 + 70 BP. The deposit and contained six charred Juglandaceae nutshell fragments, again suggesting that hickory nuts and/or walnuts were processed. The variety of uncharred seeds and rootlets in this sample represent modern plants. The few pieces of charcoal present consist of Carya, Pinus, Quercus, and an unidentifiable piece. Charred bone fragments and numerous calcined bone fragments may represent processing of faunal remains. Sclerotia and rock/gravel complete the record.

Charcoal samples 7071 and 7073 also were recovered from the same deposit. Sample 7071 consisted of five pieces of Carya charcoal, while sample 7073 contained Juniperus virginiana charcoal and charcoal-stained sediments.

Stratum 2Abo is a thin deposit of charcoal-stained sediment overlying Feature 502. Radiocarbon dates of 310 ± 50 BP and 690 + 50 BP suggest a Late Woodland age for this deposit. One flotation sample and three charcoal samples were collected from this deposit. Flotation sample 7042 contained three charred Juglandaceae nutshell fragments and a charred Rubus seed fragment. The Late Woodland occupants of the site appear to have been utilizing hickory nuts/walnuts and raspberries/blackberries. This sample also contained a variety of uncharred seeds that represent modern plants at the site. Charcoal consisted of a few small pieces of Cornus, Juniperus virginiana, and Quercus. Charred, calcined, and uncharred bone fragments suggest that animal remains were processed. A lithic flake, possible lithic flakes, and pottery fragments also represent cultural materials. Other non-floral remains include a few insect fragments, biotite, and rock/gravel.

Charcoal samples 7048 and 7055 both contained a few small pieces of Juglans, Juniperus virginiana, and Quercus charcoal, as well as charcoal-stained sediment. Walnut, eastern red cedar, and oak wood appear to have been burned as fuel. Sample 7053 contained only sediment; no charcoal fragments were noted.

Flotation samples 7034 and 7043, as well as charcoal samples 7059 and 7065, were recovered from a deposit below the natural gravel lag. A radiocarbon date of 4600 + 80 BP was returned from charcoal in this stratum. Artifacts and charcoal may have migrated into this layer from the overlying cultural deposit. Sample 7034 contained three charred Carya nutshell fragments, suggesting that hickory nuts were processed. Charred Juglandaceae nutshell fragments may represent processing of hickory nuts and/or walnuts. Small pieces of Carya, Morus, and Quercus charcoal indicate that hickory, mulberry, and oak wood was burned. Several calcined bone fragments may represent processing of animal remains. A few uncharred rootlets from modern plants, sclerotia, and rock/gravel complete the record.

Two charred Asteraceae seed fragments and a Hypericum seed and seed fragment in sample 7043 may represent resources utilized by the prehistoric occupants of the site or weedy seeds that were inadvertently charred. Use of pokeweed and a member of the raspberry group is suggested by the presence of a charred Phytolacca americana seed fragment and a charred Rubus seed. A charred unidentified seed fragment also was recovered, as well as a variety of uncharred seeds from modern plants. The charcoal record includes Juglans, Quercus, and unidentifiable charcoal. Numerous small calcined bone fragments and small uncharred bone may represent processing of animal remains. Other non-floral remains include fire-cracked rock, lithic flakes, a charred insect fecal pellet, a few insect fragments, s small clear glass fragment, and rock/gravel. Macrofloral remains from these two flotation samples are consistent with remains noted in the overlying natural gravel lag.

Carya charcoal was present in sample 7059, again indicating use of hickory wood as fuel. Pieces of probable Cornus, Juglans, and Quercus charcoal were present in sample 7065, representing use of probable dogwood, walnut, and oak wood.

* Samples from 51NW117W appear to represent mainly Late Woodland occupations of the area. During this period, the macrofloral record suggests that hickory nuts, possibly walnuts, pokeweed, and a member of the raspberry group were utilized. A variety of charcoal types indicates that several woods were burned as fuel including hickory, dogwood, ash, walnut, eastern red cedar, mulberry, pine, and oak. Samples from this site contained an abundance of small calcined bone fragments, suggesting that animal remains were processed in this area. Analysis of burned residue from several ceramic sherds found in the natural gravel lag yielded a variety of results. A root or tuber is represented by starch in one sample, suggesting processing roots/tubers. Since the majority of the organic residues sampled did not yield starch granules indicative of processing starchy remains nor phytoliths representing processing grass seeds, it is most probable that the organic residues represent processing meat or perhaps plant greens that do not contain either phytoliths or starch granules. At least one sherd yielded evidence of sponge spicules and/or round diatoms, which suggests use of water during cooking or intrusion of these remains from the surrounding sediments.

SUMMARY AND CONCLUSIONS

Pollen, phytolith, macrofloral, charcoal identification, and PET analysis at Sites 51NW103, 51NW117, and 51NW117W in the Whitehurst Freeway Project in Washington, D.C. yielded information concerning plant resources utilized by the prehistoric occupants of this area. All three sites yielded evidence of Woodland period occupations, especially during the Late Woodland. The area also may have experienced an earlier, less intensive Late Archaic occupation.

A probable late Middle Woodland cremation burial was noted at 51NW117. Pollen analysis support the interpretation that this pit contained cremated remains since no pollen was recovered from the level presumed to contain the cremation itself, but pollen was noted and identified from all other levels examined. The phytolith record indicates that magnolia probably was used at the cremation or burial. Although the fiber could not be identified, fiber/textile identification indicates that the textile was not made of grass or sedge. Charred macrofloral remains from the burial suggest that pokeweed and walnuts were processed and/or included as grave goods. Ash, possible honey locust, and pine wood appear to have been burned as fuel in the cremation or burial process.

Pollen and phytolith samples examined from fill above the cremated remains are consistent with the interpretation that trash fill was removed for the pit and replaced after the burial. The three samples examined above the cremated remains were relatively homogeneous in their content of both pollen and phytolith remains, which is consistent with mixing of these deposits. The pollen and phytolith records below the cremated remains indicate different records than were evident in the trash fill above the cremation, suggesting that local vegetation prior to this occupation included a mixed pine/hardwood forest, grasses, and herbaceous plants.

Samples from sites 51NW103 and 51NW117W represent mainly accumulation of cultural material from the Late Woodland period. Charred macrofloral remains suggest use of bedstraw, pokeweed, and wild grapes at 51NW103, while 51NW117W yielded evidence for use of hickory nuts, possibly walnuts, pokeweed, and a member of the raspberry family. Numerous small calcined bone fragments also were present in deposits from this site, suggesting that processing of animal remains was a common activity. A variety of woods appear to have been burned as fuel by the Woodland occupants of the area, including buckeye, hickory, dogwood, ash, walnut, eastern red cedar, mulberry, sycamore, pine, and oak. These trees had the potential for providing a variety of edible, medicinal, and utilitarian resources, as well as wood for fuel. Examination of residue scraped from ceramic fragments points to cooking activities using water and possibly cooking Solanum (potato) or other tubers. In addition, greens, or other plants or plant parts that do not produce either phytoliths or starch granules, or meat might have been cooked in the vessels whose organic residues were examined.

TABLE 1
PROVENIENCE DATA FOR SAMPLES FROM SITES 51NW103, 51NW117, AND 51NW117W
IN THE WHITEHURST FREEWAY PROJECT

Site No.	Sample No.	Feature No.	Provenience/ Description	Analysis
51NW103	4009		21N/14E; Fill from Ab horizon representing prehistoric refuse deposit	Float
	4047	363	20N/20E; Fill from dense cluster of FCR and ceramics in prehistoric refuse deposit	Float
	1311-4	363	Burned residue from Late Woodland ceramic sherd found in dense cluster of FCR and ceramics in prehistoric refuse deposit	PET
	1357-1		Burned residue from ceramic sherd found in prehistoric refuse deposit	PET
	4024		20N/16E; Fill from gravel lag deposit beneath prehistoric refuse deposit	Float
	4003		21N/14E; Charcoal from gravel lag deposit beneath prehistoric refuse deposit	Charcoal ID
	4022		21N/16E; Charcoal from gravel lag deposit below prehistoric refuse deposit	Charcoal ID
	4045		20N/20E; Charcoal from gravel lag deposit below prehistoric refuse deposit	Charcoal ID
	4040		21N/12E; Charcoal dust remaining after dating, from gravel lag deposit below prehistoric refuse deposit	Charcoal ID
	4055		22N/14E; Charcoal dust remaining after dating, from gravel lag deposit below prehistoric refuse deposit	Charcoal ID
	1331-1		Burned residue from ceramic found in gravel lag deposit below prehistoric refuse deposit	PET
51NW117	018		44N/17E; Column sample, 40 cm above burned portion of F-283	Pollen Phytolith
	019		44N/17E; Column sample, 30 cm above burned portion of F-283	Pollen Phytolith
	020		44N/17E; Column sample, 20 cm above burned portion of F-283	Pollen Phytolith
	021		44N/17E; Column sample, 10 cm above burned portion of F-283	Pollen Phytolith
	022	283	44N/17E; Column sample, Fill from cremation burial	Pollen Phytolith

Table 1 (continued)

Site No.	Sample No.	Feature No.	Provenience/ Description	Analysis
51NW117	023		44N/17E; Column sample, 10 cm below F-283	Pollen Phytolith
	024		44N/17E; Column sample, 20 cm below F-283	Pollen Phytolith
	5007-I	283	Textile fragment from cremation burial	Fiber
	5005	283	102N/194E; Fill from cremation burial	Float
	5013	283	103N/194E; Fill from cremation burial	Float
	5004	283	44N/17E; Charcoal from cremation burial	Charcoal ID
	5019	283	102N/194E; Charcoal from cremation burial	Charcoal ID
	5008		103N/195E; Fill from mixed historic/ prehistoric level above Feature 283	Float
	5024		103N/194E; Charcoal dust remaining after dating, from mixed historic/prehistoric level above Feature 283	Charcoal ID & PET
	3063-5		Burned residue from ceramic sherd from mixed historic/prehistoric level above Feature 283.	PET
51NW117W	7025	502	31N/30E; Fill from natural gravel deposit intermixed with ceramics, lithics, and FCR (open prehistoric surface)	Float
	7029	502	34N/31E; Fill from natural gravel deposit intermixed with ceramics, lithics, and FCR (open prehistoric surface)	Float
	7063	502	33N/33E; Charcoal from natural gravel deposit intermixed with ceramics, lithics, and FCR (open prehistoric surface)	Charcoal ID
	6107-3	502	34N/31E; Burned residue from ceramic sherd found on natural gravel deposit intermixed with ceramics, lithics, and FCR	PET
	6176-7	502	31N/31E; Burned residue from ceramic sherd found on natural gravel deposit intermixed with ceramics, lithics, and FCR	PET
	6113-14	502	Burned residue from ceramic sherd found on natural gravel deposit intermixed with ceramics, lithics, and FCR	PET
	7041	504	34N/33E; Fill from natural gravel deposit intermixed with ceramics and lithics adjacent to Feature 502, may be extension of natural gravel deposit	Float
	7071		33N/32E; Charcoal from natural gravel deposit intermixed with ceramics and lithics adjacent to Feature 502	Charcoal ID

Table 1 (continued)

Site No.	Sample No.	Feature No.	Provenience/ Description	Analysis
	7073		34N/33E; Charcoal from natural gravel deposit intermixed with ceramics and lithics adjacent to Feature 502	Charcoal ID
	7042		34N/32E; Fill from thin deposit of charcoal-enriched sediment overlying natural gravel deposit (Feature 502)	Float
	7048		33N/33E; Charcoal from thin deposit of charcoal-enriched sediment overlying natural gravel deposit (Feature 502)	Charcoal ID
	7055		34N/32E; Charcoal from thin deposit of charcoal-enriched sediment overlying natural gravel deposit (Feature 502)	Charcoal ID
	7053		34N/32E; Sediment remaining after radiocarbon dating, from thin deposit of charcoal-enriched sediment overlying natural gravel deposit (Feature 502)	Charcoal ID
	7034		34N/33E; Fill from deposit with artifacts and charcoal beneath natural gravel deposit	Float
51NW117W	7043		34N/33E; Fill from deposit with artifacts and charcoal beneath natural gravel deposit	Float
	7059		34N/33E; Charcoal from deposit with artifacts and charcoal beneath natural gravel deposit	Charcoal ID
	7065		32N/30E; Charcoal dust remaining after dating, from deposit with artifacts and charcoal beneath gravel deposit	Charcoal ID

TABLE 2
MACROFLORAL REMAINS FROM SITE 51NW103

Sample No.	Identification	Part	Charred W	Charred F	Uncharred W	Uncharred F	Weights/ Comments
4009	Liters Floated						2.1 L
	Light Fraction Weight						16.22 g
	FLORAL REMAINS:						
	Galium	Seed		1			
	Unidentified	Seed		4			
	Mollugo verticillata	Seed			14	16	
	Portulaca oleracea	Seed			9	10	
	Rootlets					X	Few
	Sclerotia					X	Numerous
	CHARCOAL/WOOD:						
	Total charcoal $\geq$ 2 mm						0.74 g
	Aesculus	Charcoal		2			0.01 g
	Carya	Charcoal		7			0.08 g
	Fraxinus	Charcoal		2			0.02 g
	Juglans	Charcoal		4			0.02 g
	Quercus - Red group	Charcoal		6			0.05 g
	Quercus - White group	Charcoal		10			0.08 g
	Unidentified bark	Charcoal/Bark		1			0.03 g
	Unidentified	Charcoal		6			0.05 g
	NON-FLORAL REMAINS:						
	Insect fecal pellet clump				1		
	Insect					3	
	Rock/Gravel					X	Moderate
4047	Liters Floated						2.3 L
	Light Fraction Weight						22.60 g
	FLORAL REMAINS:						
	Galium	Seed		1			
	Phytolacca americana	Seed		1			
	Vitis	Seed		1			
	Portulaca oleracea	Seed			1		
	Rootlets					X	Few
	Sclerotia				X		Numerous

Table 2 (continued)

Sample No.	Identification	Part	Charred W	Charred F	Uncharred W	Uncharred F	Weights/ Comments
4047	CHARCOAL/WOOD:						
	Total charcoal ≥ 2 mm						2.05 g
	Carya	Charcoal		12			0.18 g
	Fraxinus	Charcoal		13			0.20 g
	Juglans	Charcoal		7			0.21 g
	Morus	Charcoal		2			0.01 g
	Platanus	Charcoal		1			<0.01 g
	Quercus	Charcoal		5			0.08 g
	NON-FLORAL REMAINS:						
	Rock/Gravel					X	Moderate
4024	Liters Floated						2.75 L
	Light Fraction Weight						0.89 g
	FLORAL REMAINS:						
	Rootlets					X	Few
	Sclerotia					X	Few
	CHARCOAL/WOOD:						
	Total charcoal ≥ 2 mm						0.16 g
	Platanus	Charcoal		3			<0.01 g
	Quercus	Charcoal		1			<0.01 g
	Unidentified Bark	Charcoal		2			<0.01 g
	NON-FLORAL REMAINS:						
	Rock/Gravel					X	Numerous

W = Whole
F = Fragment
X = Presence noted in sample
g = grams

TABLE 3
INDEX OF MACROFLORAL REMAINS RECOVERED FROM SITES 51NW103, 51NW117, AND 51NW117W IN THE WHITEHURST FREEWAY PROJECT

Scientific Name	Common Name
FLORAL REMAINS:	
Amaranthus	Pigweed, amaranth
Asteraceae	Sunflower family
Brassicaceae	Mustard family
Chenopodium	Goosefoot
Cyperaceae	Sedge family
Cyperus	Flatsedge
Eleusine	Goosegrass
Galium	Bedstraw, Cleaver's
Hypericum	St. Johnswort
Juglandaceae	Walnut family
Carya	Hickory
Lamiaceae	Mint family
Hedeoma-type	
Mollugo verticillata	Carpetweed
Oxalis stricta	Wood sorrel
Phytolacca americana	Pokeweed
Portulaca oleracea	Purslane
Rubus	Raspberry, blackberry, etc.
Sambucus	Elderberry
Stellaria	Starwort
Trifolium	Clover
Verbascum	
Vitis	Grape

Table 3 (continued)

Scientific Name	Common Name
CHARCOAL/WOOD:	
Aesculus	Buckeye
Carya	Hickory, Pecan
Cornus	Dogwood
Fraxinus	Ash
Juglans	Walnut
Juniperus	Juniper
Morus	Mulberry
Pinus	Pine
Platanus	Sycamore
Quercus	Oak

TABLE 4

IDENTIFICATION OF CHARCOAL FROM SITES 51NW103, 51NW117, AND 51NW117W
IN THE WHITEHURST FREEWAY PROJECT

Site No.	Sample No.	Identification	Part	Charred		Uncharred		Weight
				W	F	W	F	
51NW103	4003	Cornus	Charcoal		25			0.74 g
		Charcoal-stained soil					X	
	4022	Cornus	Charcoal		5			0.30 g
		Sediment					X	
	4045	Quercus	Charcoal		30			0.89 g
	4040	Cornus	Charcoal		X			
		Unidentified	Charcoal		X			
	4055	Unidentifiable (too small)	Charcoal		X			
51NW117	5004	Juglans	Nutshell		1			0.29 g
		Fraxinus	Charcoal		18			2.24 g
		Pinus	Charcoal		42			23.73 g
		Sediment					X	
	5019	Fraxinus	Charcoal		20			29.78 g
		cf. Gleditsia triacanthos	Charcoal		10			12.17 g
	5024	Quercus	Charcoal		X			
		Vitrified tissue			X			
51NW117W	7063	Carya	Nutshell		6			0.29 g
		Fraxinus	Charcoal		9			0.10 g
		Pinus	Charcoal		1			0.02 g
		Quercus	Charcoal		1			0.008 g
		Sediment					X	
	7071	Carya	Charcoal		5			0.12 g
	7073	Juniperus virginiana	Charcoal		21			0.06 g
		Charcoal-stained soil					X	
	7048	Juglans	Charcoal		3			0.29 g
		Juniperus virginiana	Charcoal		4			0.05 g
		Quercus	Charcoal		1			0.01 g
		Charcoal-stained soil						
	7055	Juglans	Charcoal		3			0.01 g
		Juniperus virginiana	Charcoal		1			0.12 g
		Quercus	Charcoal		1			0.11 g
		Charcoal-stained soil					X	
	7053	Sediment					X	
	7059	Carya	Charcoal		30			1.63 g
		Sediment					X	
51NW117W	7065	cf. Cornus	Charcoal		X			
		Juglans	Charcoal		X			
		Quercus	Charcoal		X			

W = Whole F = Fragment g = grams X = Presence noted in sample

TABLE 5

POLLEN TYPES OBSERVED IN SAMPLES FROM SITES 51NW103, 51NW117, AND 51NW117W OF THE WHITEHURST FREEWAY PROJECT

Scientific Name	Common Name
ARBOREAL POLLEN:	
Betulaceae	Birch family
Carya	Hickory, Pecan
Juniperus	Juniper
Magnolia/Liriodendron-type	Poplar
Pinus	Pine
Quercus	Oak
NON-ARBOREAL POLLEN:	
Asteraceae:	Sunflower family
Cirsium-type	Thistle
Low-spine	Includes ragweed, cocklebur, etc.
High-spine	Includes aster, rabbitbrush, snakeweed, sunflower, etc.
Tubuliflorae	Includes eroded Low- and High-spine
Liguliflorae	Includes dandelion and chicory
Brassicaceae	Mustard family
Cheno-am	Includes amaranth and pigweed family
Cyperaceae	Sedge family
Medicago-type	Medick
Phlox	Phlox
Poaceae:	Grass family

TABLE 5 (Continued)

Scientific Name	Common Name
Polygonum aviculare-type	Knotweed
Rosaceae:	Rose family
Rosa-type	Wild rose
Indeterminate	
SPORES:	
Monolete	Fern
Trilete	Fern
Sporormiella	Dung fungus

TABLE 6
MACROFLORAL REMAINS FROM SITE 51NW117

Sample No.	Identification	Part	Charred W	Charred F	Uncharred W	Uncharred F	Weights/ Comments
5005	Liters Floated						1.75 L
	Light Fraction Weight						9.56 g
	FLORAL REMAINS:						
	Brassicaceae	Silique				1	
	CHARCOAL/WOOD:						
	Total charcoal ≥ 2 mm						4.25 g
	Pinus	Charcoal		50			1.39 g
	Unidentifiable (vitrified)	Charcoal		X			Moderate
	NON-FLORAL REMAINS:						
	cf. Flake				1		
	Biotite					X	Numerous
	Rock/Gravel				X		Present
5013	Liters Floated						1.8 L
	Light Fraction Weight						35.84 g
	FLORAL REMAINS:						
	Phytolacca americana	Seed		2			
	Braided fibers			X			Moderate
	Fibers			X			Numerous
	Vitrified tissue			X			Numerous
	Rootlets					X	Few
	Sclerotia					X	Moderate
	CHARCOAL/WOOD:						
	Total identifiable charcoal	≥ 2 mm					0.52 g
	Pinus	Charcoal		30			0.41 g
	Unidentifiable (vitrified)	Charcoal		X			Numerous
	NON-FLORAL REMAINS:						
	Bone			12			
	Biotite					X	Moderate
	Rock/Gravel					X	Present

Table 6 (continued)

Sample No.	Identification	Part	Charred W	Charred F	Uncharred W	Uncharred F	Weights/ Comments
5008	Liters Floated						2.5 L
	Light Fraction Weight						8.42 g
	FLORAL REMAINS:						
	Asteraceae	Seed	1				
	Galium	Seed	1				
	Phytolacca americana	Seed		20			
	Vitrified tissue			18			
	Amaranthus	Seed			1	1	
	Cyperaceae	Seed			1		
	Portulaca oleracea	Seed			14	1	
	Sambucus	Seed			1		
	Stellaria	Seed			2		
	Trifolium	Seed			1		
	Sclerotia					X	Few
	CHARCOAL/WOOD:						
	Total charcoal $\geq$ 2 mm						0.32 g
	Carya	Charcoal		5			<0.01 g
	Cornus	Charcoal		2			<0.01 g
	Juglans	Charcoal		2			0.01 g
	Juniperus virginiana	Charcoal		3			0.02 g
	Morus	Charcoal		4			<0.01 g
	Pinus	Charcoal		2			<0.01 g
	Quercus	Charcoal		6			0.01 g
	Unidentified	Charcoal		7			0.08 g
	NON-FLORAL REMAINS:						
	Calcined bone			63			
	Rock/Gravel					X	Moderate

W = Whole
F = Fragment
X = Presence noted in sample
g = grams

TABLE 7
MACROFLORAL REMAINS FROM SITE 51NW117W

Sample No.	Identification	Part	Charred W	Charred F	Uncharred W	Uncharred F	Weights/ Comments
7025	Liters Floated						1.25 L
	Light Fraction Weight						11.25 g
	FLORAL REMAINS:						
	Juglandaceae	Nutshell		5			0.01 g
	Phytolacca americana	Seed		4			
	Unidentifiable	Seed		1			
	Mollugo verticillata	Seed			2		
	Portulaca oleracea	Seed			2	2	
	Trifolium	Seed			1		
	Rootlets					X	Few
	Sclerotia					X	Few
	CHARCOAL/WOOD:						
	Total charcoal $\geq$ 2 mm						0.05 g
	Quercus	Charcoal		2			0.04 g
	Unidentified bark	Charcoal		1			<0.01 g
	Unidentifiable	Charcoal		3			<0.01 g
	NON-FLORAL REMAINS:						
	Bone			3			
	Calcined bone			839*			
	Rock/Gravel					X	Moderate
7029	Liters Floated						1.0 L
	Light Fraction Weight						6.50 g
	FLORAL REMAINS:						
	Juglandaceae	Nutshell		16			0.05 g
	Phytolacca americana	Seed		1			
	Mollugo verticillata	Seed			4		
	Portulaca oleracea	Seed			21	6	
	Trifolium	Seed			1		
	Rootlets					X	Few
	Sclerotia					X	Few

Table 7 (continued)

Sample No.	Identification	Part	Charred W	Charred F	Uncharred W	Uncharred F	Weights/ Comments
7029	CHARCOAL/WOOD:						
	Total charcoal ≥ 2 mm						0.10 g
	Carya	Charcoal		2			<0.01 g
	Morus	Charcoal		1			<0.01 g
	Pinus	Charcoal		1			<0.01 g
	Quercus	Charcoal		X			0.05 g
	Unidentifiable	Charcoal		X			0.03 g
	NON-FLORAL REMAINS:						
	Bone			4			
	Calcined bone			881*			
	Rock/Gravel					X	Moderate
7041	Liters Floated						0.75 L
	Light Fraction Weight						4.748 g
	FLORAL REMAINS:						
	Juglandaceae	Nutshell		6			
	Chenopodium	Seed			1		
	Cyperus	Seed			1		
	Lamiaceae	Seed			1		
	Mollugo verticillata	Seed			35*	13	
	Oxalis stricta	Seed			1		
	Portulaca oleracea	Seed			30*	162*	
	Rubus	Seed				1	
	Rootlets					X	Moderate
	Sclerotia				X		Moderate
	CHARCOAL/WOOD:						
	Total charcoal ≥ 2 mm						0.08 g
	Carya	Charcoal		1			<0.01 g
	Pinus	Charcoal		2			0.03 g
	Quercus	Charcoal		10			0.03 g
	Unidentifiable	Charcoal		1			0.01 g

Table 7 (continued)

Sample No.	Identification	Part	Charred W	Charred F	Uncharred W	Uncharred F	Weights/ Comments
	NON-FLORAL REMAINS:						
	Bone			7			
	Calcined bone			378*			
7042	Liters Floated						1.0 L
	Light Fraction Weight						5.15 g
	FLORAL REMAINS:						
	Juglandaceae	Nutshell		3			
	<u>Rubus</u>	Seed		1		6	
	<u>Chenopodium</u>	Seed			1		
	<u>Eleusine</u>	Seed			1		
	Lamiaceae	Seed			3		
	<u>Hedeoma</u>-type	Seed			4	2	
	<u>Mollugo verticillata</u>	Seed			96*	32*	
	<u>Oxalis stricta</u>	Seed			10	6	
	<u>Phytolacca americana</u>	Seed				1	
	<u>Portulaca oleracea</u>	Seed			568*	212*	
	<u>Sambucus</u>	Seed				1	
	<u>Stellaria</u>	Seed			1		
	<u>Trifolium</u>	Seed			3		
	<u>Verbascum</u>	Seed			1		
	Rootlets					X	Few
	Sclerotia				X		Numerous
	CHARCOAL/WOOD:						
	Total charcoal $\geq$ 2 mm						0.03 g
	<u>Cornus</u>	Charcoal		3			0.01 g
	<u>Juniperus virginiana</u>	Charcoal		2			<0.01 g
	<u>Quercus</u>	Charcoal		4			0.02 g
	NON-FLORAL REMAINS:						
	Bone			1		26*	
	Calcined bone			124*			
	Flake				1		
	cf. Flake				X		
	Pottery					2	
	Insect					3	

Table 7 (continued)

Sample No.	Identification	Part	Charred W	Charred F	Uncharred W	Uncharred F	Weights/ Comments
	Biotite					X	Moderate
	Rock/Gravel					X	Present
7034	Liters Floated						2.0 L
	Light Fraction Weight						1.305 g
	FLORAL REMAINS:						
	Juglandaceae	Nutshell		7			
	Carya	Nutshell		3			
	Rootlets					X	Few
	Sclerotia				X		Few
	CHARCOAL/WOOD:						
	Total charcoal ≥ 2 mm						0.03 g
	Carya			2			0.01 g
	Morus			2			0.01 g
	Quercus			4			0.01 g
	NON-FLORAL REMAINS:						
	Calcined bone			51			
	Rock/Gravel					X	Moderate
7043	Liters Floated						1.0 L
	Light Fraction Weight						7.35 g
	FLORAL REMAINS:						
	Asteraceae	Seed		2			
	Hypericum	Seed	1	1			
	Phytolacca americana	Seed		1			
	Rubus	Seed	1				
	Unidentified	Seed		1			
	Amaranthus	Seed			2		
	Cyperus	Seed			1		
	Lamiaceae	Seed			4		
	Hedeoma-type	Seed			1		
	Mollugo verticillata	Seed			5		
	Oxalis stricta	Seed			3		
	Portulaca oleracea	Seed			21	3	
	Trifolium	Seed			2		

Table 7 (continued)

Sample No.	Identification	Part	Charred W	Charred F	Uncharred W	Uncharred F	Weights/ Comments
	Rootlets					X	Few
	Sclerotia				X		Numerous
7043	CHARCOAL/WOOD:						
	Total charcoal ≥ 2 mm						0.20 g
	Juglans	Charcoal		1			0.04 g
	Quercus	Charcoal		7			0.04 g
	Unidentifiable	Charcoal		7			0.09 g
	NON-FLORAL REMAINS:						
	Bone					24*	Small
	Calcined bone			728*			Small
	Fire-cracked rock					2	
	Flake				2		
	Insect fecal pellet		1				
	Insect					5	
	Glass					1	
	Rock/Gravel				X		

W = Whole
F = Fragment
X = Presence noted in sample
g = grams
* = Estimated frequency

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WHITEHURST FREEWAY PROJECT HISTORIC SAMPLES

Sample No.	Identification	Part	Charred		Uncharred W	Uncharred F	Weights/ Comments
6016-62	Citrus sp.	Seed			1		0.03 g
6024-90	Cucurbita sp.	Seed			2	1	0.06 g
6038-102	Juglans cf. nigra	Nutshell				5	7.50 g
6038-104	Prunus sp. (plum)	Pit				1	0.06 g
6155-75	Corylus americana	Nutshell				1	0.18 g
6196-85	Prunus persica	Pit			1	8	11.23 g
6196-86	Aesculus sp.	Seed		4			1.17 g
6196-87	Cocos nucifera	Nutshell				2	3.68 g
7078	Morus	Wood				1	1.72 g

W = Whole
F = Fragment
g = grams